CHAPTER 6. OPERATING LIMITATIONS AND INFORMATION
Section 1. GENERAL

365. SECTION 23.1501 (as amended by amendment 23-21) GENERAL.

a. Explanation.

(1) Flight Crew Information. This section establishes the obligation to inform the flight crew of the airplane's limitations and other information necessary for the safe operation of the airplane. The information is presented in the form of placards, markings, and an approved AFM. Appendix 4 can be used to assist in determining which methods of presentation are required.

(2) Minimum Limitations. Sections 23.1505 thru 23.1527 prescribe the minimum limitations to be determined. Additional limitations may be required.

(3) Information Presentation. Sections 23.1541 thru 23.1589 prescribe how the information should be made available to the flight crew.

b. Procedures. None.

366. SECTION 23.1505 (as amended by amendment 23-7) AIRSPEED LIMITATIONS.

a. Explanation. This section establishes the operational speed limitations which establish safe margins below design speeds. For reciprocating engine-powered airplanes there is an option. They may either establish a never-exceed speed (V_{NE}) and a maximum structural cruising speed (V_{NO}) or they may be tested in accordance with § 23.335(b)(4) in which case the airplane is operated under a maximum operating speed concept (V_{MO}/M_{MO}). For turbine-powered airplanes, a V_{MO}/M_{MO} should be established. Tests associated with establishing these speeds are discussed under § 23.253, High Speed Characteristics.

b. Procedures. None.

367. SECTION 23.1507 (original issue) MANEUVERING SPEED. This regulation is self-explanatory.

368. SECTION 23.1511 (original issue) FLAP EXTENDED SPEED. This regulation is self-explanatory.

369. SECTION 23.1513 (original issue) MINIMUM CONTROL SPEED. This regulation is self-explanatory.

370. SECTION 23.1519 (original issue) WEIGHT AND CENTER OF GRAVITY. This regulation is self-explanatory.

371. SECTION 23.1521 POWERPLANT LIMITATIONS. (RESERVED).

372. SECTION 23.1523 (as amended by amendment 23-21) MINIMUM FLIGHT CREW. All configurations evaluated should be carefully documented.

373. SECTION 23.1523 (as amended by amendment 23-34) MINIMUM FLIGHT CREW.

a. Discussion. The following should be considered in determining minimum flight crew.

(1) Basic Workload Functions. The following basic workload functions should be considered:

(i) Flight path control.

(ii) Collision avoidance.

(iii) Navigation.

(iv) Communications.

(v) Operation and monitoring of aircraft controls.

(vi) Command decisions.

(vii) Accessibility and ease of operation of necessary controls.

(2) Workload Factors. The following workload factors are considered significant when analyzing and demonstrating workload for minimum flight crew determination:

(i) The impact of basic airplane flight characteristics on stability and ease of flight path control. Some factors such as trimmability, coupling, response to turbulence, damping characteristics, control breakout forces and control force gradients should to be considered in assessing suitability of flight path control. The essential elements are the physical effort, mental effort and time required to track and analyze flight path control features and the interaction with other workload functions.

(ii) The accessibility, ease, and simplicity of operation of all necessary flight, power, and equipment controls, including emergency fuel shutoff valves, electrical controls, electronic controls, pressurization system controls, and engine controls.

(iii) The accessibility and conspicuity of all necessary instruments and failure warning devices such as fire warning, electrical system malfunction, and other failure or caution indicators. The extent to which such instruments or devices direct the proper corrective action is also considered.

(iv) For reciprocating-engine-powered airplanes, the complexity and difficulty of operation of the fuel system with particular consideration given to the required fuel management schedule necessitated by center of gravity, structural, or other airworthiness considerations. Additionally, the ability of each engine to operate continuously from a single tank or source which is automatically replenished from other tanks if the total fuel supply is stored in more than one tank.

(v) The degree and duration of concentrated mental and physical effort involved in normal operation and in diagnosing and coping with malfunctions and emergencies, including accomplishment of checklist, and location and accessibility of switches and valves.

(vi) The extent of required monitoring of the fuel, hydraulic, pressurization, electrical, electronic, deicing, and other systems while en route. Also, recording of engine readings, etc.

(vii) The degree of automation provided in the event of a failure or malfunction in any of the aircraft systems. Such automation should ensure continuous operation of the system by providing automatic crossover or isolation of difficulties and minimize the need for flight crew action.

(viii) The communications and navigation workload.

(ix) The possibility of increased workload associated with any emergency that may lead to other emergencies.

(x) Passenger problems.

(3) Kinds of Operation Authorized. During minimum crew determination, consideration should be given to the kinds of operation authorized under § 23.1525. Inoperative equipment could result in added workload that would affect minimum crew. It may be determined that due to minimum crew workload considerations, certain equipment must be operative for a specific kind of operation.

b. Acceptable Techniques.

(1) General.

(i) A systemtic evaluation and test plan should be developed for any new or modified airplane. The methods for showing compliance should emphasize the use of acceptable analytical and flight test techniques. The crew complement should be studied through a logical process of estimating, measuring, and then demonstrating the workload imposed by a particular flight deck design.

(ii) The analytical measurements should be conducted by the manufacturer early in the airplane design process. The analytical process which a given manufacturer uses for determining crew workload may vary depending on flight deck configuration, availability of a suitable reference, original design or modification, etc.

(2) Analytical Approach.

(i) A basis for deciding that a new design is acceptable is a comparison of a new design with a previous design proven in operational service. By making specific evaluations and comparing new designs to a known baseline, it is possible to proceed in confidence that the changes incorporated in the new designs accomplish the intended result. When the new flight deck is considered, certain components may be proposed as replacements for conventional items, and some degree of rearrangement may be contemplated. New avionics systems may need to be fitted into existing panels, and newly automated systems may replace current indicators and controls. As a result of this evolutionary characteristic of the flight deck

design process, there is frequently a reference flight deck design, which is usually a conventional airplane that has been through the test of operational usage. If the new design represents an evolution, improvement attempt, or other deviation from this reference flight deck, the potential exists to make direct comparisons. While the available workload measurement techniques do not provide the capacity to place precise numbers on all the relevant design features in reference to error or accident potential, these techniques do provide a means for comparing the new proposal to a known quantity. Service experience should be researched to assure that any existing problems are understood and not perpetuated.

(ii) After studying a new component or arrangement and exercising it in practical flight scenarios, a test pilot may not be able to grade that design in finer workload units than "better" or "worse than." If the pilot can say with reliability and confidence that it is or is not easier to see a display or to use an augmented control system than to use a functionally similar unit of a reference design, then these "better" or "worse than" judgments, if corroborated by a reasonable sample of qualified pilots over various assumed flight regimes, provide substantial evidence that workload is or is not reduced by the innovation.

(A) If an early subjective analysis by FAA flight test personnel shows that workload levels may be substantially increased, a more in-depth evaluation or flight testing may be required to prove acceptability of the increased workload. In this case, there should be available workload latitude in the basic flight deck design to accommodate the increase.

(B) If the new design represents a "revolutionary" change in level of automation or pilot duties, analytic comparison to a refererence design may have lessened value. Without a firm data base on the time required to accomplish both normally required and contingency duties, more complete and realistic simulation and flight testing will be required.

(3) Testing.

(i) In the case of the minimum crew determination, the final decision is reserved until the airplane has been flown by a panel of experienced pilots, trained and qualified in the airplane. The training should be essentially that required for a type rating. Where single pilot approval is sought by the applicant, the evaluation pilots should be experienced and proficient in single pilot operations. Section 23.1523 contains the criteria for determining the minimum flight crew. These criteria contain basic workload functions and workload factors.

(ii) The workload factors are those factors which should be considered when evaluating the basic workload functions. It is important to keep in mind the key terms basic workload and minimum cues when analyzing and demonstrating workload. For example, an evaluation of communiations workload should include the basic workload required to properly operate the airplane in the environment for which approval is sought. The goal of evaluating crew complement during realistic operating conditions is important to keep in mind if a consistent evaluation of minimum flight crew is to be accomplished.

(iii) The flight test program for showing compliance should be proposed by the applicant and should be structured to address the following factors:

(A) Route. The routes should be constructed to simulate a typical area that is likely to provide some adverse weather and Instrument Meteorological Conditions (IMC), as well as a representative mix of navigation aids and Air Traffic Control (ATC) services.

(B) Weather. The airplane should be test flown in a geographical area that is likely to provide some adverse weather such as a turbulence and IMC conditions during both day and night operations.

(C) Crew Work Schedule. The crew should be assigned to a daily working schedule representative of the type of operations intended, including attention to passenger cabin potential problems. The program should include the duration of the working day and the maximum expected number of departures and arrivals. Specific tests for crew fatigue are not required.

(D) Minimum Equipment Test. Preplanned dispatch-inoperative items that could result in added workload should be incorportaed in the flight test program. Critical items and reasonable combinations of inoperative items should be considered in dispatching the airplane.

(E) Traffic Density. The airplane should be operated on routes that would adequately sample high density areas, but should also include precision and nonprecision aproaches, holdings, missed approaches, and diversion to alternate airports.

(F) System Failures. Consequences of changes from normal to failed modes of operation should be included in the program. Both primary and secondary systems should be considered.

(G) Emergency Procedures. A sampling of various emergencies should be established in the test program to show their effect on the crew workload.

NOTE: Prior to selecting the system failure and emergency procedures that will be evaluated in the flight test program, analytical studies of proposed abnormal and emergency procedures should be conducted. The acceptability of all procedures should be verified and the crew workload distribution during the execution of these procedures understood to assure selection of appropriate failure cases.

(4) Determining Compliance.

(i) The type certification team that serves as pilots and observers should be equipped with flight cards or other means that allow for recordkeeping of comments addressing the basic workload functions. These records should be accumulated for each flight or series of flights in a given day. In addition, the certification team should record the accuracy of using operational checklists. For the purposes of this data gathering, the airplane should be configured to allow the team evaluators to observe all crew activities and hear all communications both externally and internally.

(ii) Each subparagraph of paragraph 373a summarizes an observation of pilot performance that is to be made. Judgment by the certification team members should be that each of these tasks has been accomplished within reasonable preestablished workload standards during the test flights. A holistic pilot evaluation rationale is needed in view of the wide variety of possible designs and crew configurations that makes it unfeasible to assume that ratings are made against every alternative and against some optimum choices. The regulatory criteria for determining minimum flight crew do not adapt well to finely-scaled measurements. Specific feature and activity pass-fail judgments should be made. Pass means that the airplane meets the minimum requirements.

374. SECTION 23.1524 (as added by amendment 23-10) MAXIMUM PASSENGER SEATING CONFIGURATION. This regulation is self-explanatory.

375. SECTION 23.1525 (original issue) KINDS OF OPERATION.

a. Explanation.

(1) Required Equipment. See discussion under § 23.1583(h), paragraph 411 of this AC, concerning required equipment for each certificated kind of operation.

(2) Icing. With respect to operations in icing conditions, it is important that operating limitations be established in order to specify the required equipment in § 23.1583(h) and to provide the proper placard required by § 23.1559 (flight in icing approved or prohibited).

376. SECTION 23.1527 (as added by amendment 23-7) MAXIMUM OPERATING ALTITUDE.

a. Explanation.

(1) Safe Operation. Section 23.1527 requires the establishment of a maximum operating altitude for all turbine, turbosupercharged, and pressurized airplanes based on operation limited by flight, structural, powerplant, functional, or equipment characteristics. Section 23.1501(a) requires limitations necessary for safe operation be established. Thus, if an unsafe condition occurs beyond a particular operating altitude for any airplane, that altitude should be established as a limitation under § 23.1501(a).

(2) Windshields and Windows. As stated in § 23.1527(a), pressurized airplanes are limited to 25,000 feet unless the windshield/window provisions of § 23.775 are met.

(3) Factors. The maximum operating altitude listed in the AFM should be predicated on one of the following:

(i) The maximum altitude evaluated.

(ii) The restrictions, as a result of unsatisfactory structures, propulsion, systems, and/or flight characteristics.

(iii) Consideration of § 23.775 for pressurized airplanes.

b. Procedures. Assuming that the structure has been properly substantiated, the flight evaluation should consist of at least the following:

(1) Stall characteristics per §§ 23.201 and 23.203 with wing flaps up, gear retracted, and power at the maximum power that can be attained at the maximum altitude, not to exceed 75% maximum continuous.

(2) Stall warning, cruise configuration only (§ 23.207).

(3) Longitudinal stability, cruise configuration only (§§ 23.173 and 23.175).

(4) Lateral and directional stability, cruise configuration only (§§ 23.177 and 23.181).

(5) Upsets, if required (§ 23.253).

(6) Systems operation, including icing system, if installed.

(7) Propulsion operation, including stall, surge, and flameout tests throughout the speed range from near stall to maximum level flight speed.

377.-386. RESERVED.

Section 2. MARKINGS AND PLACARDS

387. SECTION 23.1541 (as amended by amendment 23-21) GENERAL.

a. Required Markings and Placards. The rule specifies which markings and placards must be displayed. Note that § 23.1541(a)(2) requires any additional information, placards, or markings required for safe operation. Some placard requirements are obscurely placed in other requirements. For example, § 23.1583(e)(2) requires a placard for acrobatic category airplanes concerning spin recovery. A checklist is provided in appendix 4 which may assist in determination of placards and markings required.

b. Multiple Categories. For airplanes certified in more than one category, § 23.1541(c)(2) requires all of the placard and marking information to be furnished in the AFM. This practice is encouraged for all airplanes.

c. Powerplant Instruments. Advisory Circular (AC) 20-88A provides additional guidance on the marking of powerplant instruments.

388. SECTION 23.1543 (original issue) INSTRUMENT MARKINGS: GENERAL. Advisory Circular (AC) 20-88A provides guidance on the marking of powerplant instruments.

389. SECTION 23.1545 (as amended by amendment 23-23) AIRSPEED INDICATOR. This regulation is self-explanatory.

390. SECTION 23.1547 (as amended by amendment 23-20) MAGNETIC DIRECTION INDICATOR. This regulation is self-explanatory.

391. SECTION 23.1549 POWERPLANT INSTRUMENTS. (RESERVED).

392. SECTION 23.1551 OIL QUANTITY INDICATOR. (RESERVED).

393. SECTION 23.1553 FUEL QUANTITY INDICATOR. (RESERVED).

394. SECTION 23.1555 CONTROL MARKINGS. (RESERVED).

395. SECTION 23.1557 MISCELLANEOUS MARKINGS AND PLACARDS. (RESERVED).

396. SECTION 23.1559 (as amended by amendment 23-21) OPERATING LIMITATIONS PLACARD. This regulation is self-explanatory.

397. SECTION 23.1561 (original issue) SAFETY EQUIPMENT.

a. Examples of Safety Equipment. Safety equipment includes such items as life rafts, flares, fire extinguishers, and emergency signaling devices.

b. Requirements. Sections 23.1411 thru 23.1419 cover the requirements for safety equipment.

398. SECTION 23.1563 (as amended by amendment 23-7) AIRSPEED PLACARDS. This regulation is self-explanatory.

399. SECTION 23.1567 (as amended by amendment 23-21) FLIGHT MANEUVER PLACARD. This regulation is self-explanatory.

400.-409. RESERVED.

Section 3. AIRPLANE FLIGHT MANUAL AND APPROVED MANUAL MATERIAL

410. SECTION 23.1581 (as amended by amendment 23-34) GENERAL.

a. GAMA Specification No. 1. General Aviation Manufacturers Association (GAMA) Specification No. 1, Revision No. 1, dated September 1, 1984, provides broad guidance for contents of a Pilot's Operating Handbook (POH) which will fulfill the requirements of an AFM if the POH meets all of the requirements of §§ 23.1581 thru 23.1589. There is no objection to the title, "Pilot's Operating Handbook," if the title page also includes a statement indicating that the document is an FAA-required AFM and is FAA approved.

b. Optional Presentations. Beginning with amendment 23-21, applicants are provided with an option for the presentation of the required procedures, performance, and loading information. The regulatory requirements of the two options are given in §§ 23.1581(b)(1) and 23.1581(b)(2). The options are as follows:

(1) Section 23.1581(b)(1). The AFM must have approved limitations, procedures, performance, and loading sections. These approved sections must be segregated, identified, and clearly distinguished from unapproved information furnished by the applicant if any unapproved information is furnished. Normally,

FAA approval is indicated by the signature of the Aircraft Certification Office Manager, or his representative, on the cover page and a page effectivity table so that it is clear to the operational pilot exactly which pages are applicable and the date of approval.

(2) Section 23.1581(b)(2). The AFM must have an approved limitations section and this approved section must contain only limitations (no procedures, performance, or loading information allowed). The limitations section must be identified and clearly distinguished from other parts of the AFM. The remainder of the manual may contain a mixture of approved and unapproved information, without segregation or identification. However, the other required material (procedures, performance, and loading information) must be determined in accordance with the applicable requirements of Part 23. The meaning of "acceptable," as used in § 23.1581(b)(2)(ii), is given in the preamble to amendment 23-21. The applicable portion of the amendment 23-21 preamble is as follows:

> "In finding that a manual is acceptable, the FAA would review the manual to determine that the required information is complete and accurate. The manual would also be reviewed to ensure that any additional information provided by the applicant is not in conflict with required information or contrary to the applicable airworthiness requirements."

The indication of approval for the approved section should be as discussed in the preceding paragraph. GAMA Specification No. 1 has been found to comply with the provisions of § 23.1581(b)(2).

c. Part 36 Noise Limitations and/or Procedures.

(1) If the applicant chooses the § 23.1581(b)(1) option, operating limitations required by Part 36 should be placed in the Operating Limitations portion of the AFM. Any Part 36 procedures should be placed in the Operating Procedures portion of the AFM.

(2) If the applicant chooses the § 23.1581(b)(2) option, the approved AFM should contain the following approved, but separate, portions:

(i) Operating limitations prescribed in § 23.1583. Note that § 23.1581(b)(2)(i) limits the information in this portion to that prescribed in § 23.1583. Since the present Part 36 limitation is a weight limitation, the Part 36 limitation may be included.

(ii) Operating procedures prescribed by Part 36. Section 36.1581(a) requires Part 36 procedures to be approved.

d. STC Procedures.

(1) AFM Options. STC applicants are responsible for preparing an AFM supplement when the airplane has been modified in such a manner that limitations, procedures, or performance have been changed. The supplement should be prepared

in accordance with the guide provided in appendix 5 and reflect the necessary supplemental information. Alternately, the applicant may choose to prepare a new AFM. If the applicant selects the latter option, the new AFM replaces the original AFM in its entirety.

(2) Performance. Concerning performance, if the STC applicant does not want credit for any increased performance and demonstrates that the performance meets or exceeds all basic airplane performance, a general statement to that effect would be satisfactory.

e. Additional Information. Some additional information items that are required for safe operation because of unusual design, operating, or handling characteristics are as follows:

(1) Operation of strobe lights during flight through fog, clouds, or flying closely under an overcast.

(2) Use of carburetor heat.

(3) Restricted use of flaps during sideslips.

(4) Management of propeller pitch when Beta Range is provided.

(5) Procedures for the temporary use of sand screens and engine heater devices.

(6) Unusual feathering design where propeller will not feather with throttle closed.

(7) Scheduling for fuel flow by engine mixture leaning procedure.

(8) Unusual spin recovery techniques.

(9) Wheelbarrowing characteristics.

(10) Pilot-induced oscillations or oscillations caused by turbulence, particularly on swept-wing airplanes.

(11) Depressurization procedures prior to landing.

(12) Procedures for operation of automatic devices; that is, wing levelers, mach trim, yaw damper, etc.

411. SECTION 23.1583 (as amended by amendment 23-34) OPERATING LIMITATIONS.

a. Limitations Section. The purpose of the Limitations Section is to present the limitations applicable to the airplane model by serial number, if applicable, as established in the course of the type certification process in determining compliance with Parts 23 and 36 of the FAR. The limitations should be presented without explanation other than those explanations prescribed in Parts 23

and 36. The operating limitations contained in the Limitations Section (including any noise limited weights) should be expressed in mandatory, not permissive, language. The terminology used in the AFM should be consistent with the relevant regulatory language.

b. GAMA Specification. GAMA Specification No. 1, Revision No. 1 dated September 1, 1984, section 2, provides guidance for the contents of the limitations section. Additional guidance is provided below for "Kinds of Operation," "Fuel Limitations," and "Commuter Category."

c. Kinds of Operation Equipment List (KOEL). The KOEL is to be placed in the limitations section of the AFM since the KOEL items form part of the limitations applicable to airplane operation. The sample KOEL given in appendix 6 lists systems and equipment for a specific airplane in an acceptable format. Although the sample KOEL may contain items that are not applicable to all airplanes, it may be used as a guide.

Although there is no specific format required for the KOEL, we recommend, in the interest of standardization, that the KOEL be columned and each item of equipment required for a specific type of operation for which the airplane is approved be noted in the appropriate column. Regardless of the format used, the KOEL should provide for:

(1) The kinds of operation for which the airplane was type certificated (that is, day or night Visual Flight Rules (VFR), day or night Instrument Flight Rules (IFR), and icing conditions).

(2) The identity of the systems and equipment upon which type certification for each kind of operation was predicated and must be installed and operable for the particular kind of operation indicated. Systems and equipment necessary for certification includes those:

(i) required under the basic airworthiness requirements,

(ii) required by the operating rules (FAR 91 requirements, as a minimum),

(iii) required by special conditions,

(iv) required to substantiate equivalent safety findings,

(v) required by airworthiness directives (AD), and

(vi) items of equipment and/or systems not specifically required under items (i) thru (v) of this paragraph but used by the applicant in order to show compliance with the regulations.

The KOEL should not:

(1) Contain those obvious components required for the airplane to be airworthy such as wings, empennage, engines, landing gear, brakes, etc.

(2) Contain an exceptions column.

d. Fuel Limitations. The fuel limitations discussion in GAMA Specification 1 may not be applicable depending on the airplane certification basis.

e. Commuter Category Airplanes. For those performance weight limits which may vary with runway length, altitude, temperature, and other variables, the variation in weight limitation may be presented as graphs in the Performance Section of the manual and included as limitations by specific reference in the Limitations Section of the AFM.

412. SECTION 23.1585 (as amended by amendment 23-34) OPERATING PROCEDURES.

a. Explanation. See GAMA Specification 1.

b. Electronic Checklist Displays.

(1) Background. Checklists, both hard copy and electronic displays, are a method used by manufacturers to provide (in part) the normal and emergency operating procedures required by § 23.1585 of the FAR, and its predecessor, § 3.779 of the CAR. Section 23.1581 of the FAR/§ 3.777 of the CAR is also applicable for the manner and format of presentation. Many airplanes under Part 23 of the FAR/Part 3 of the CAR do not require, nor do they have, an approved AFM. Therefore, electronic checklist displays for these airplanes would continue to be unapproved.

(2) Display Content. For those airplanes with approved AFM's, the wide variety of configurations and corresponding flight manual supplements within a single model may establish a virtually unique set of checklist procedures for each individual airplane. The responsibility for electronic checklist display contents rests with the operator. A hard copy of the AFM should be available to the operator for reference.

(3) AFM Changes. Incorporation of STCs could necessitate changes to the flight manual, flight manual supplements, or addition of new supplements. These supplements could require revision to the checklist for that particular airplane. Such changes should be made by the operator.

(4) Operator Revisions. Although it is not necessary for equipment manufacturers to store electronic checklist data in such a manner that it cannot be changed in the field, some equipment manufacturers have chosen to program checklist data in a manner that prevents field alteration. The operator would be responsible for ensuring the checklist data is revised as necessary upon installation of new/different equipment.

(5) Disclaimers. Electronic checklists are usually displayed on the same cathode-ray tube (CRT) as other electronic displays. Certain disclaimer statements may be appropriate. Presentation of a disclaimer statement each time the equipment is turned on will provide adequate notification to the pilot. This disclaimer should include statements that clearly state:

(i) Contents of the checklists are the responsibility of the operator.

(ii) The FAA-approved AFM takes precedence in case of conflicting checklist information.

(6) Automatic Display. Automatic display of appropriate checklists during conditions of engine failure, generator failure, etc., will require a review based upon the specific application involved. Approval of the checklist content, malfunction prioritization, and operation is required.

413. SECTION 23.1587 (as amended by amendment 23-34) PERFORMANCE INFORMATION.

a. Performance Information. This section contains the airworthiness performance information necessary for operation in compliance with applicable performance requirements of Part 23, applicable special conditions, and data required by Part 36. Additional information and data essential for implementing special operational requirements may be included. Performance information and data should be presented for the range of weight, altitude, temperature, airplane configurations, thrust rating, and any other operational variables stated for the airplane.

b. Normal, Utility, and Acrobatic Category Airplanes. See GAMA Specification 1.

c. Commuter Category Airplanes.

(1) General. Include all descriptive information necessary to identify the precise configuration and conditions for which the performance data are applicable. Such information should include the complete model designations of airplane and engines, the approved flap, sweep, or canard settings, definition of installed airplane features and equipment that affect performance, together with the operative status thereof (e.g., anti-skid devices, automatic spoilers, etc.). This section should also include definitions of terms used in the Performance Section (e.g., IAS, CAS, ISA, configuration, net takeoff flight path, icing conditions, etc.), plus calibration data for airspeed (flight and ground), Mach number, altimeter, ambient air temperature, and other pertinent information.

(2) Performance Procedures. The procedures, techniques, and other conditions associated with attainment of the flight manual performance data should be included. Performance procedures may be presented as a performance subsection or in connection with a particular performance graph. In the latter case, a comprehensive listing of the conditions associated with the particular performance may serve the objective of "procedures" if sufficiently complete.

(3) Thrust or Power Setting. Thrust or power settings should be provided for at least takeoff and maximum continuous and the methods required to obtain the performance shown in the AFM. If appropriate, these data may be required to be shown for more than one thrust setting parameter.

(4) Takeoff Speeds. The operational takeoff speeds V_1, V_R, and V_2 should be presented together with associated conditions. Section 23.1587(d)(6) requires the speeds be given in CAS. Since the aircrew flies IAS, the airspeeds should also be presented in IAS. The V_1 and V_R speeds should be based upon "ground effect" calibration data; the V_2 speeds should be based upon "free air" calibration data.

(5) Takeoff Distance. Takeoff distance should be shown in compliance with §23.59.

(6) Climb Limited Takeoff Weight. The climb limited takeoff weight which is the most limiting weight showing compliance with § 23.67 should be provided.

(7) Miscellaneous Takeoff Weight Limits. Takeoff weight limits, for any equipment or characteristic of the airplane configuration which imposes an additional takeoff weight restriction, should be shown (e.g., tire speed limitations, brake energy limitations, etc.).

(8) Takeoff Climb Performance. For the prescribed takeoff climb airplane configurations, the climb gradients should be presented together with associated conditions. The scheduled climb speed(s) should be included.

(9) Takeoff Flight Path Data. The takeoff flight paths of § 23.61 or performance information necessary to enable construction of such paths, together with associated conditions (e.g., procedures, speed schedules), should be presented for the configurations and flight path segments existing between the end of the presribed takeoff distance and the point of attaining the en route climb configuration airspeed or 1500 feet, whichever is higher.

(10) En Route Climb Data. The climb gradients prescribed in § 23.67 should be presented together with associated conditions, including the speed schedule used.

(11) Climb Limited Landing Weight. The climb limited landing weight which is the most limiting weight showing compliance with § 23.77.

(12) Landing Approach Speeds. The scheduled speeds associated with the approved landing distances should be presented together with associated conditions.

(13) Landing Distance. The landing distance from a height of 50 feet should be presented together with associated ambient temperature, altitude, wind conditions, and weights up to the maximum landing weight. Operational landing distance data should be presented for smooth, dry, and hard-surfaced runways. At the option of the applicant, with concurrence by the FAA, additional data may be presented for wet or contaminated runways, and for other than smooth, hard-surfaced runways. At the option of the applicant, FAR 135 landing field length and alternate landing field length may be presented.

414. SECTION 23.1589 (original issue) LOADING INFORMATION. See GAMA Specification 1.

415.-424. RESERVED.